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Paper E 9

APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT

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ABSTRACT

ERTS-1 imagery is being used by the New Jersey Department of Environmental Protection (NJDEP) to develop information products that will assist the state in optimally managing its coastal resources and in allocating funds. Interviews with NJDEP personnel have identified significant problem areas in the coastal zone, and the types of remote sensor derived information products that can be used in real-time decision making.

Initial analyses of imagery from several successive ERTS-1 orbits have shown the extent, predominant drift, and dispersion characteristics of waste disposal in coastal New Jersey waters. Imagery (MSS Bands 4 and 5) for several orbits, shows the New York Harbor tidal discharge extending as far south as Long Branch, New Jersey.

Within the bays, sounds, and thorofares behind the barrier islands in the southern New Jersey shore area, increased reflectance of the turbid waters has enabled the investigators to examine the effects of a large sewage effluent flow into these waters. As these waters are flushed with each tidal change, the turbid waters emanate out to the populous bathing beaches.

Analysis of early ERTS-1 data indicates that the concept of repetitive looks at coastal circulation dynamics along the New Jersey shore will provide the kinds of information necessary for more effective coastal management decision making within the New Jersey Department of Environmental Protection.

INTRODUCTION

New Jersey's coastal zone has been subjected to the demands of a growing population and the rapid industrialization which are common to states on the East and Gulf Coasts. The public has become more aware of the ecological damage that is taking place in the coastal zone while at

the same time placing more and more demands on this area for recreation. It is unlikely that any coastal area in the eastern United States will escape the influence or domination of development in the next decade. At the same time these areas must protect their recreational attractions, the most important of which is clean water. Up to the present time, man has indiscriminately used estuarine and coastal areas as an ultimate sink for the disposal of his wastes.

The capacity of coastal areas to assimilate these wastes has been reached in many areas, and a burgeoning population is threatening waters in other areas. In order to meet the problems of pollution and development, New Jersey requires additional data on coastal and estuarine environments. There is a need to know the fate of nearshore deposited wastes, the rates at which they disperse, the directions in which they travel, the rates at which an estuary can flush itself of pollutants, and the effects of an estuarine discharge on the surrounding environment.

In addition to the problem of coastal pollution, New Jersey is challenged by the continual modification of its shorelines by micro and macroscale littoral processes. The State has an active shoreline protection program which the state pays 75% of the costs of shoreline protection and the municipalities the remaining 25%. For fiscal year 1971, shore communities requested aid for projects valued at over $25,000,000 with a state share at over $19,000,000. Since the available funds are less than required for shoreline protection, there is a strong state need for ERTS-1 data, which can be used for funds-allocation. Such information is essential to the environmentally sound development of New Jersey's coastal zone.

The state of New Jersey has been a leader among states in the operational use of remote sensing techniques for resource mapping. The New Jersey Wetlands Act of 1970 and the subsequent mapping of thier entire wetlands using remote sensing techniques is an example of New Jersey's interest in protecting its coastal resources through the use of remote sensing.

Because of the information needs mentioned above, the geographical extent of these interlinking estuarine systems, the dynamics of tidal progression, and the variability of climatically controlled environmental parameters, ERTS-1 offers a significant (economic, synoptic, and logistic) complement to conventional methods of data acquisition.

OBJECTIVES

The general hypothesis upon which this investigation is based, is that useful information products can be derived from ERTS-1 monitoring of tidal and nearshore circulation dynamics in near real-time, and that

they can be applied by the State to the effective management and protection of its Coastal Zone.

The principal thrust of the program is towards results and useful products founded on sound oceanographic and environmental protection principals, while taking advantage of the synoptic and repetitive properties of ERTS-1.

APPROACH

To achieve these goals, a working interface has been established between the New Jersey Department of Environmental Protection and Earth Satellite Corporation. Initial interviews were held in the various Divisions and Bureaus of the Department to determine the kinds of problems being addressed and the information needs, i.e. what types of data are used, what additional data can be used, frequency requirements, and data accuracy requirements. During initial and follow up interviews, the major needs cited most often related to coastal engineering and pollution control. Information on nearshore circulation is one of the most important contributions that ERTS-1 can provide. Individual needs vary depending on the specific application of data. The Division of Water Resources for example, needs information that would lead to the better placement of ocean outfalls. Whereas, the Division of Marine Services needs information that would lead to better allocation of funds for shore protection structures.

Preliminary analysis and use of ERTS data have centered on these four major problem areas of importance to the State.

- OFFSHORE WASTE DISPOSAL
- ESTUARINE FLUSHING DYNAMICS
- WETLANDS BOUNDARY DISCRIMINATION
- COASTAL ZONE DELINEATION

RESULTS

New Jersey, New York, and the Federal Government are concerned over offshore dumping of waste materials into the New York Bight area. The effects of this waste disposal on future recreational use of the coastal zone, fish resources, aesthetic damage, and health; need to be understood.

There are three major dumping grounds offshore New Jersey; the acid

grounds, sewage sludge area, and the dredge spoil area. Those dumps imaged so far (Figure 1) are primarily acid and dredge spoil. The acid is the most reflective and is dumped in a characteristic hair pin pattern. The dredge spoil is loaded with particulate matter but is dumped over a much smaller area. The sewage sludge contains only 1%-3% solids and is therefore much less reflective than the other two types of dumps. The dispersion and movement of all relict dumps imaged so far has been to the west, toward the New Jersey Shoreline. Figure 1 illustrate the magnitude of the dumping itself and the radial dispersion from the designated dumping sites.

In southern New Jersey, work is centered around the Atlantic City area where an attempt is being made to forecast estuarine flushing volumes. Approximately 26 million gallons/day of domestic and industrial effluents (85% of which is only receiving primary treatment) is being emptied into the waters behind the barrier islands fronting the Atlantic City area. Analysis is underway incorporating the back-basin geometry, tidal prism, turbidity, and modeled dispersion coefficients to compare the actual volumes discharged to the normalized reflectance values in the nearshore and estuarine waters. With these data an estimate of the flushing volumes can be used by the Division of Water Resources in planning future growth.

Color composites and a mosaic of MSS Band 7 were used to delineate an upper wetland boundary for coastal New Jersey. The pink to reddish tonal signatures of the wetland vegetation, the position of the vegetation between barrier beaches and the mainland and along tidal streams, all aided in the identification and separation of wetland from upland areas. Experience gained from mapping New Jersey's upper wetland boundary using 1:12,000 color infrared aerial photography as part of the New Jersey Wetlands Mapping Program also aided in wetland vegetation identification. The tonal and textural signatures of wetland vegetation were considerably different from those of upland plant species and the boundary was drawn along a distinct tonal and textural break. Along the Delaware River tonal signatures indicative of wetland species could be identified along stream channels, but these signatures were more subtle than those seen along the coast. This map is of course a gross delineation in comparison to the 1:12,000 scale, but for illustrative purposes, this type of map is very useful.

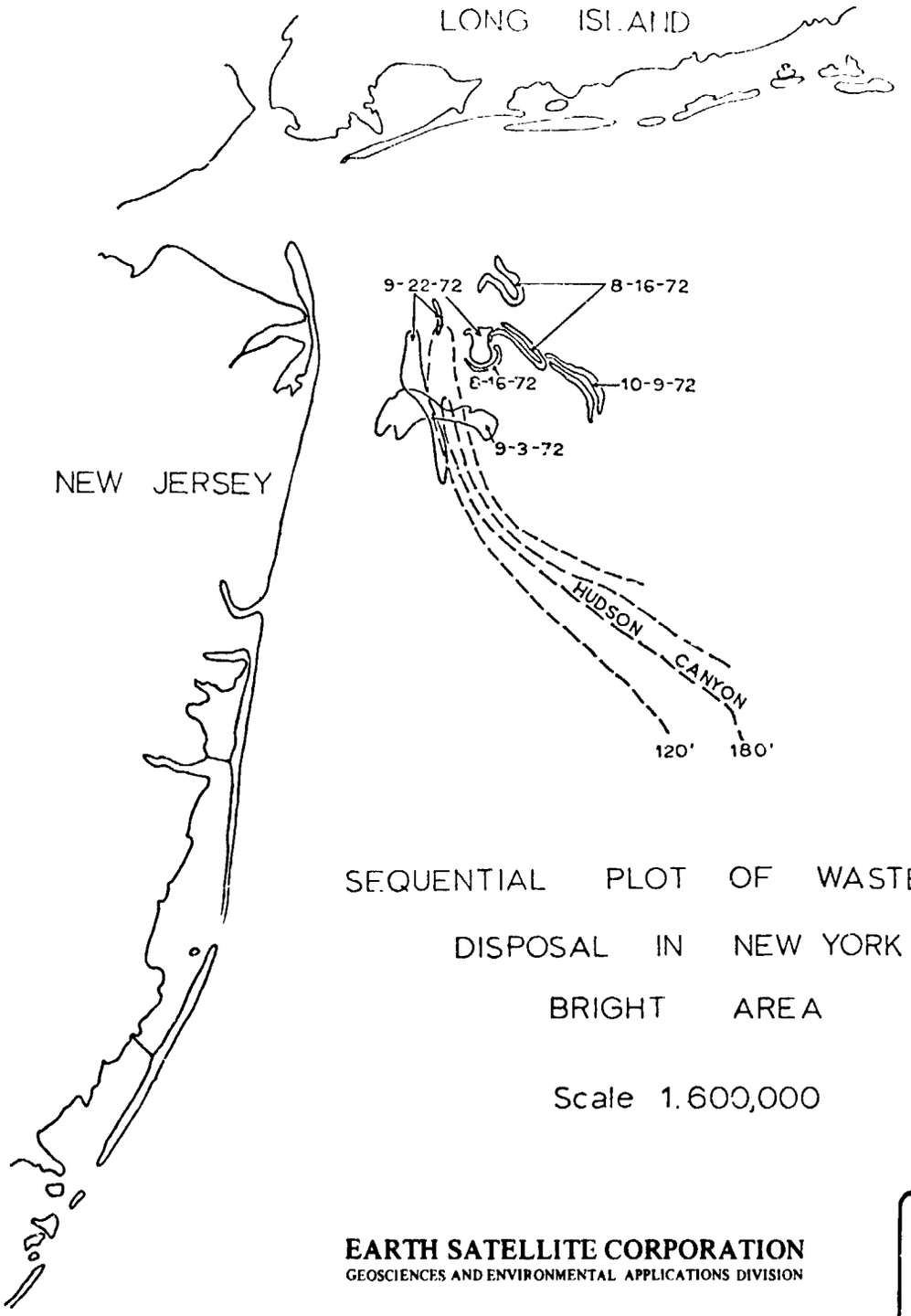
More recently, the New Jersey Department of Environmental Protection has used ERTS-1 imagery (mosaic of MSS band 5) to illustrate and explain before the State Legislature the extent of the coastal zone as defined in New Jersey's "Coastal Area Facility Review Act." New Jersey realizes that its coastal zone is a unique and irreplaceable natural resource, and that the economy of the entire State will suffer serious adverse effects if the environmental impact resulting from the

future location of major facilities is not carefully assessed. For these reasons, ERTS-1 imagery was found to be most useful in explaining the States position in regard to protecting the coastal area.

SUMMARY

These are only preliminary results of an on-going investigation of New Jersey's coastal zone. Several categories of operationally oriented products are being prepared by EARTHSAT for State use. Some of these products have been explained in the previous sections. Product development is a continuous process and is responsive to the needs of the State.

EARTHSAT and the NJDEP have recognized that ERTS-1 data and the analysis thereof can lead to the development of practical information products that can go a long way towards solving many of the near term, real world problems of the coastal environment.



SEQUENTIAL PLOT OF WASTE DISPOSAL IN NEW YORK BRIGHT AREA

Scale 1.600,000

EARTH SATELLITE CORPORATION
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